



EHS 0806 Basic Accident Investigation

(Edited with permission from DTI)

Introduction

This course is designed to provide resources and information about conducting thorough and effective accident investigations.

This course is designed for someone new to accident investigation as well as those experienced in accident investigations.

These course materials can be used in several ways:

- Review all the training materials content.
- Utilize the menu feature to navigate to just the topics that are relevant to each student.
- Serve as a reference or refresher tool at various times.

Instructions

- Review the Menu to determine if you want to complete the entire course or skip to various sections.
- There are speakers notes on most slides for when you want further details and information about a particular topic.
- There is a Summary/Review for each section to help reinforce key 'takeaways'.
- When you are complete please go to the last slide for instructions on how to receive course credit.
- You can come back to the course as often as you want.

Menu Titles

1. Berkeley Lab Accident Investigation Resources
2. Objectives, Basics, & Incident Investigation Program
3. Six Step Investigation Process
4. Collecting Facts
5. Sequence of Events
6. Determining the Causes
7. Developing Recommendations
8. Writing the Report
9. Putting it all Together
10. Course Credit

Berkeley Lab Accident Investigation Resources

Melanie Alexandre, EHS Occupational Injury and Illness Program

- mmalexandre@lbl.gov or 510-486-6840

Occupational Injury and Illness Review Website

- <https://ehs.lbl.gov/service/occupational-safety/occupational-injury-illness-review/>

Injury Review Toolkit

- <https://ehs.lbl.gov/resource/documents/occupational-safety/injury-review-toolkit/>

ESH Manual Chapter 5: Injury Response and Review

- <https://drive.google.com/file/d/1GY7oFy4PWCdfD6LF8Q9t5U8D63iR20JD/view>

Occupational Injury and Illness Monthly Accident Statistics

- <https://ehs.lbl.gov/resource/documents/occupational-safety/monthly-accident-statistics/>

Custom Reporting Tool

- https://cogweb.lbl.gov/cognos/cgi-bin/cognosisapi.dll?b_action=xts.run&m=portal/cc.xts&m_tab=iD05694AFF2464DB297E0DC7B1BA51DB7

Objectives

Terminal Objective

Given information regarding an accident or incident, students will be able to identify the key concepts of conducting an investigation in accordance with the six-step process as taught in class.

Enabling Objectives

1. State the difference between an accident and an incident.
2. List the characteristics of an effective accident investigation program.
3. Describe the six-step process for conducting an accident investigation.
4. State the difference between an unsafe act and an unsafe condition.

The Basics

Accident vs. Incident

DOE defines accidents as an unplanned event that suggests failure of a safety system

OSHA says accidents could not have been prevented whereas incidents could have been prevented

What two conditions must exist before an accident occurs?

A hazard and exposure

What are motivations to investigate and analyze accidents?

Save lives and money, prevent future injuries—it's the right thing to do

Investigation Program

What are some characteristics of an effective investigation program?

1. Clearly stated and easy to follow written procedures
2. Clearly assigned responsibility for conducting investigations
3. Formal training for all investigators
4. Separation of the investigation from disciplinary procedures
5. A written report addressing causes; including recommendations
6. Follow-up procedures for short- and long-term corrective actions
7. Annual review of accident reports

Summary/Review

What two key conditions must exist before an accident occurs?

- Hazard and Exposure

Are accidents always unplanned? Explain.

- No. Some accidents result from hazardous conditions and unsafe behaviors that have been ignored or tolerated for weeks, months, or even years.

What are the characteristics of an effective accident investigation program?

- Written procedures
- Assigned responsibility
- Formal training
- Separation of the accident investigation from any potential disciplinary procedures
- Written report
- Follow-up procedures
- An annual review of accident reports

Six-Step Investigation Process

Gather the information

Steps one and two ensure the accident scene does not change and information is gathered immediately.

Step 1: Preserve and document the accident scene.

Step 2: Collect the facts through interviews.

Analyze the facts

Steps three and four break the accident/incident “process” into distinct steps so that each of them may be analyzed to determine causes.

Step 3: Develop the sequence of events.

Step 4: Determine the causes.

Implement solutions

Steps five and six recommend and communicate corrective actions and management solutions to make sure similar accidents/incidents do not reoccur.

Step 5: Recommend improvements.

Step 6: Write the report.

The purpose of the investigation is to determine why the accident occurred so it can be prevented from happening again; the purpose is not to find fault.

Preserve and Document

Why should an investigation begin immediately?

To preserve material evidence and memory

What are effective methods to document an accident scene?

Personal observation, statements, photos, video, and sketches

When must OSHA be notified of an accident?

29 CFR 1904.39, Reporting fatalities, hospitalizations, amputations, and losses of an eye as a result of work-related incidents to OSHA

(a) *Basic Requirement.* **Within eight (8) hours** after the death of any employee or **within twenty-four (24) hours** after the in-patient hospitalization of one or more employees or an employee's amputation or loss of an eye, as a result of a work-related incident, you must report the fatality, hospitalization, amputation, or loss of an eye, by telephone or in person, to the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, Area Office that is nearest to the site of the incident. You may use the OSHA toll-free central telephone number, 1-800-321-OSHA (1-800-321-6742).

Securing Accident Scene

- Determining what information is relevant to what, how, and why the accident happened.
- Identifying physical clues that answer these questions is crucial for effective accident scene documentation.
- To gather the information critical to determining the cause of an accident, the accident scene must be secured as quickly as possible to prevent material evidence from being relocated or removed.

Remember, at this point, the focus of the investigation is not to determine what caused the accident, but to gather as much information as possible for later analysis.

Effective methods to document scene and collect facts

- Personal observation... use all the senses to see, hear and smell
- Initial statements of witnesses
- Photographs
 - Should be systematic... either distance, then move toward accident scene or vise versa
 - Different angles, panoramic, take notes about each picture being taken, place an item of known dimension in the frame
- Video recording
 - Scan 360 degrees; narrate and describe what is being recorded
- Sketches
 - Components include: spatial relationships, measurements, location of photographs and documentation

Summary/Review

What is the most practical way to secure an accident scene?

The scene may be coned off, taped off, guarded, etc.

What might be the result if the investigation is not initiated as soon as possible?

Tools, equipment, or people could be moved or disappear from the scene. As time passes, an individual's emotions and conversations with others distort what they believe they saw and heard. The memory of everyone affected by the accident will eventually be altered in some way.

If a work-related fatality of any employee occurs, the affected employer must notify the Occupational Safety and Health Administration (OSHA) within what timeframe?

- A. Twenty-four hours
- B. Sixteen hours
- C. **Eight hours**
- D. Four hours

When documenting the scene, one of the biggest challenges facing the investigator is?

- A. Determining who is to blame
- B. **Determining what is relevant**
- C. Determining who is in charge
- D. Determining who is liable

Collecting Facts

When should an interview take place?

As soon as possible while information is still fresh in people's minds

When should an interview not take place?

When a witness is seriously ill in the hospital, in a hurry, distraught, or when unfavorable environmental conditions exist

Who should be interviewed?

Victims, coworkers, managers, training department, medical personnel

What are some things to do in an interview?

State interviewer's role/intentions, take notes, be open minded, listen carefully, and communicate clearly.

Who should be interviewed?

Victims	To determine specific events leading up to and including the accident
Coworkers	To establish what actual vs. appropriate procedures have been used
Direct Supervisor	To get background information on the victim and obtain procedural information about the task being performed
Manager	Can be the main source of information on related systems
Training Department	To get information on quantity and quality of training the victim and others have received
Personnel Department	To get information on the victim's and other's work history, discipline, appraisals, etc.
Maintenance Personnel	To determine background on equipment/machinery maintenance
EMTs	To learn what they saw when they arrived and during the response
Medical Personnel	To get medical information (as allowed by law)
Coroner	To determine the type/extent of fatal injuries
Police	If they filed a report
Victim's Family	May have insight into the victim's state of mind or other issues
Other Persons	Anyone else who may be a valuable source of information

What are some things interviewers should do?

- Put person at ease
- Explain purpose
- Take notes carefully and casually
- Be open minded
- Meet in 'neutral location'
- Let the individual talk... do not interrupt
 - 'Can you please describe in detail what happened?'
- Ask open-ended questions
 - Avoid asking 'why' and leading questions
 - Ask clarifying questions if needed
- Try being 'neutral' in body language, facial expressions, and tone
- Repeat facts and sequence of events
- Ask for interviewee's suggestions as to how the accident could have been avoided

Collecting Facts

What are some things not to do in an interview?

Argue, suggest possible answers, rush the process, interview in crowds

State the key questions regarding interviewing.

Who, where, what, when, how

Why is it important to interview documents in addition to people?

Verify statements/facts, no memory loss

What are some things interviewers should avoid?

- Do not use tape recorder unless given permission
- Avoid being argumentative, defensive or suggest possible answers or explanations
- Do not rush... give enough time
- Do not conduct interviews in crowds



Click here to access link to a list of Accident Investigation Interview Questions:

<https://docs.google.com/document/d/1j6UcKeDpKFn56dWISDobitmWU2PxLS4IQhFM6gEv6eU/edit?usp=sharing>

What documents should be reviewed?

Record	Why—What do you expect to find?
Training	Determine types and quality of training received.
Maintenance	Determine history of tools, equipment, and machinery.
Discipline	Determine if discipline occurred previously.
Safety Committee	Determine history of related hazardous conditions, behaviors, or program elements.
Injury/Illness	Determine previous or similar events.
Work Schedule	Determine if victim was overworked and possibly fatigued.
Coroner	Determine direct cause of death.
Weather	Determine if adverse conditions were a factor.
Procedures	Determine the process that should have been followed.

Summary/Review

What relevant information might be obtained by reviewing the OSHA Injury and Illness records?

Accident history, injury/illness trends, etc.

What is the purpose of the interview process? How do you best achieve that purpose?

Uncover additional information about the hazardous conditions, unsafe work practices, and related system weaknesses that contribute to the accident. Cooperation, not intimidation, is the key to successful interviews.

Which of the following is an effective interview technique?

- A. Ask “why-you” questions.
- B. Ask open-ended questions.
- C. Interview in crowds.
- D. Encourage fault finding.

Why is it important to repeat the facts and sequence of events back to the interviewee?

To avoid misunderstandings

Sequence of Events

What is developing a sequence of events critical for?

Breaking down the complexity of an accident into manageable, easier-to-understand pieces

What is identified in each event in an unplanned accident?

An actor and an action

The boy cried when the dog scared him.

Actor: boy

Action: cried

Actor: dog

Action: scared him

Summary/Review

An “event” occurs when a(n) _____ performs a(n) _____.
Actor; action

Name the actor(s) and action(s) for the following:

“Robert used a wrench to pound a nail.”

Actor: Robert

Action: Used a wrench

Actor: Robert

Action: Pound a nail

Actor: Wrench

Action: Pound a nail

Developing the sequence of events is critical in the accident “analysis” process to:

- A. Find out who to interview.
- B. Fix the system.
- C. Place the blame.
- D. Document the scene.

Determining the Causes

What are the various causation theories that attempt to explain why accidents occur?

Single-Factor Theory

- Caused by single, easily identifiable, unusual, and unexpected occurrence

Domino Theory

- Caused by a linear chain reaction of occurrences that lead to a final event
- Focuses on unsafe acts by individual(s)

Multiple-Cause Theories

- Caused by a series of complex interactions
- Recognizes both unsafe acts and unsafe conditions

Accident Weed



Multiple Causation and the Accident Weed

1. Direct Causes

- Always the harmful transfer of energy
- Kinetic, thermal, chemical, etc.
- Contact with, exposure to, etc.

2. Indirect Causes

Primary Indirect Causes

- Produces the accident
- Unique hazardous condition/unsafe behavior
- Exists/occurs close to the injury event
- Involves the victim, possibly others

Contributing Indirect Causes

- Contributes to the accident
- Unique hazardous condition
- Inappropriate/unsafe behavior
- Exists/occurs more distant from the accident
- Exists/occurs anytime, anywhere, by anyone

3. Root Causes

Inadequate System Implementation

- Failure to carry out safety policies, programs, plans, processes, procedures, or practices
- Pre-exist indirect causes
- Under control of management
- Failure can occur anytime, anywhere
- Produces common indirect causes

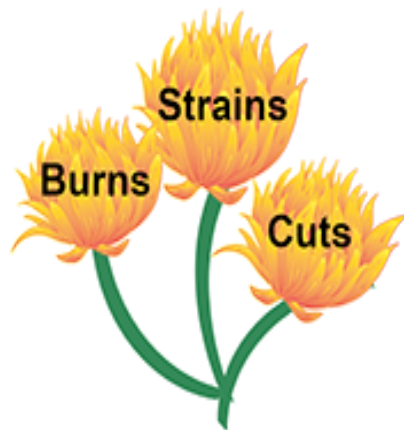
Inadequate System Design

- Poorly written or missing policies, programs, plans, processes, procedures, or practices
- Pre-exist indirect causes
- Under top management control
- Produces inadequate implementation

Any way you look at it, design is the key to an effective safety management system. If design is flawed, yet perfectly implemented, the system fails. If design is perfect, yet implementation is flawed, the system fails as a result of design flaws in other related processes.

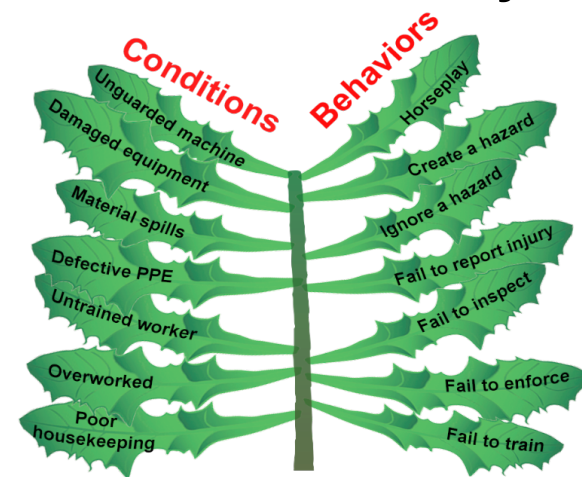
Levels of Analysis- Direct Cause Analysis

Direct Cause Analysis



Example:
Laceration to right forearm
Burn on left thigh from chemicals

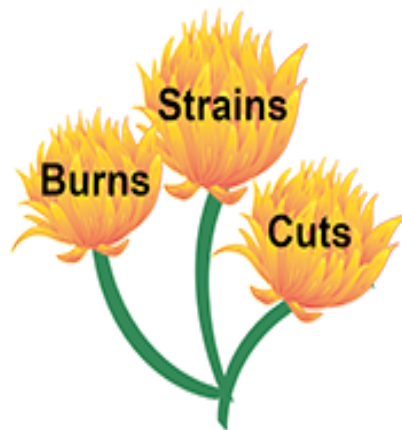
Indirect Cause Analysis



Example:
Unguarded saw blade
Working at elevations without fall protection

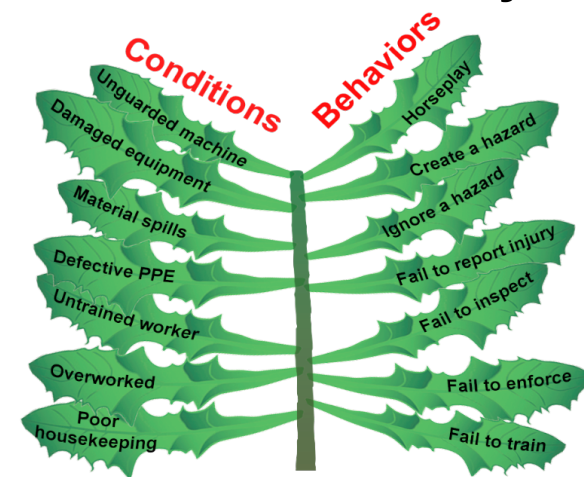
Levels of Analysis- Indirect Cause Analysis

Direct Cause Analysis



Example:
Laceration to right forearm
Burn on left thigh from chemicals

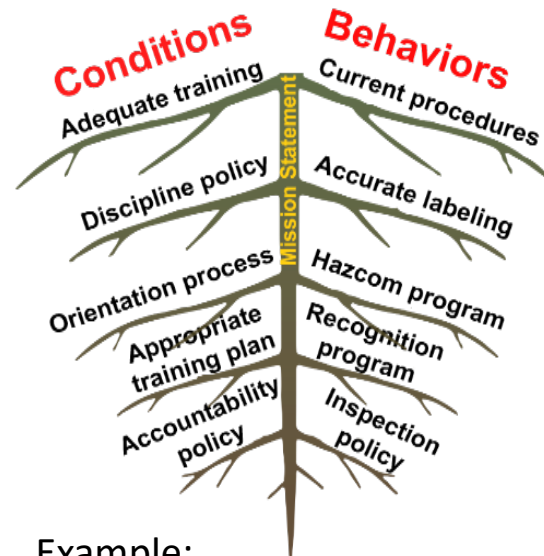
Indirect Cause Analysis



Example:
Unguarded saw blade
Working at elevations without fall protection

Levels of Analysis

Root Cause Analysis



Example:

Inadequate training

No inspection policy

Example of how to put the information together



Summary/Review

Which theory below describes an accident as “a series of linear occurrences that lead to an event, which results in injury or illness”?

- A. Single-factor theory
- B. Multiple cause theory
- C. Domino theory
- D. System weakness theory

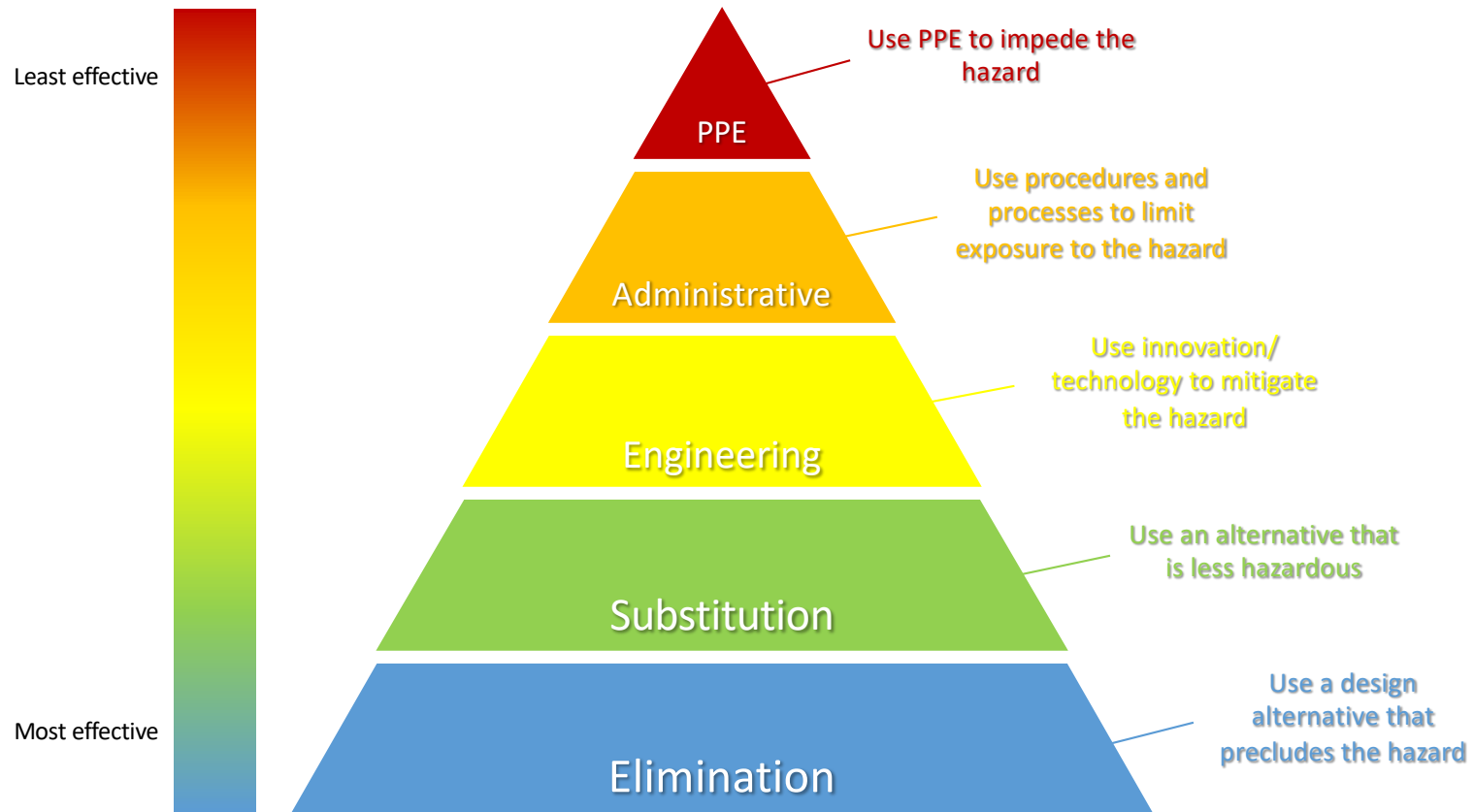
The three levels of cause analysis are?

Direct cause analysis, indirect cause analysis, root cause analysis

The underlying safety system weaknesses are called?

Root causes

Developing Recommendations: Hierarchy of Controls



Direct and Indirect Costs



Cost/Benefit Analysis

Determine the costs.

Estimate direct/indirect costs for most likely injury if corrective actions are not taken.

Describe factors that were considered upon arriving at an estimate.

Determine benefits of solving the problem.

Fulfilling social, fiscal, legal obligations

Determine return on investment.

For every dollar spent on investments, how much will be saved by preventing the accident?

“How much is the recommendation going to cost, and how much will it benefit the organization?”

Calculating Indirect Costs

Return on Investment (ROI)

To calculate indirect cost, multiply direct cost by a cost multiplier.
The cost multiplier that you use will depend on the size of the direct cost

If your direct cost is: Use this cost multiplier:

\$0 - \$2,999	4.5
\$3,000 - \$4,999	1.6
\$5,000 - \$9,999	1.2
\$10,000 or more	1.1

Direct Costs	×	Cost Multiplier	= Indirect Cost
\$59,372	×	1.1	= \$65,309

What are the total costs of the accident?

Direct Costs:	\$59,372	+	Indirect Costs:	\$65,309	=	\$124,681
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$$\begin{aligned} \text{Simple ROI} &= \frac{\text{Gains} - \text{Investment Costs}}{\text{Investment Costs}} \\ &= \frac{\$700,000 - \$500,000}{\$500,000} \\ &= 40\% \end{aligned}$$

Present Options



Option A



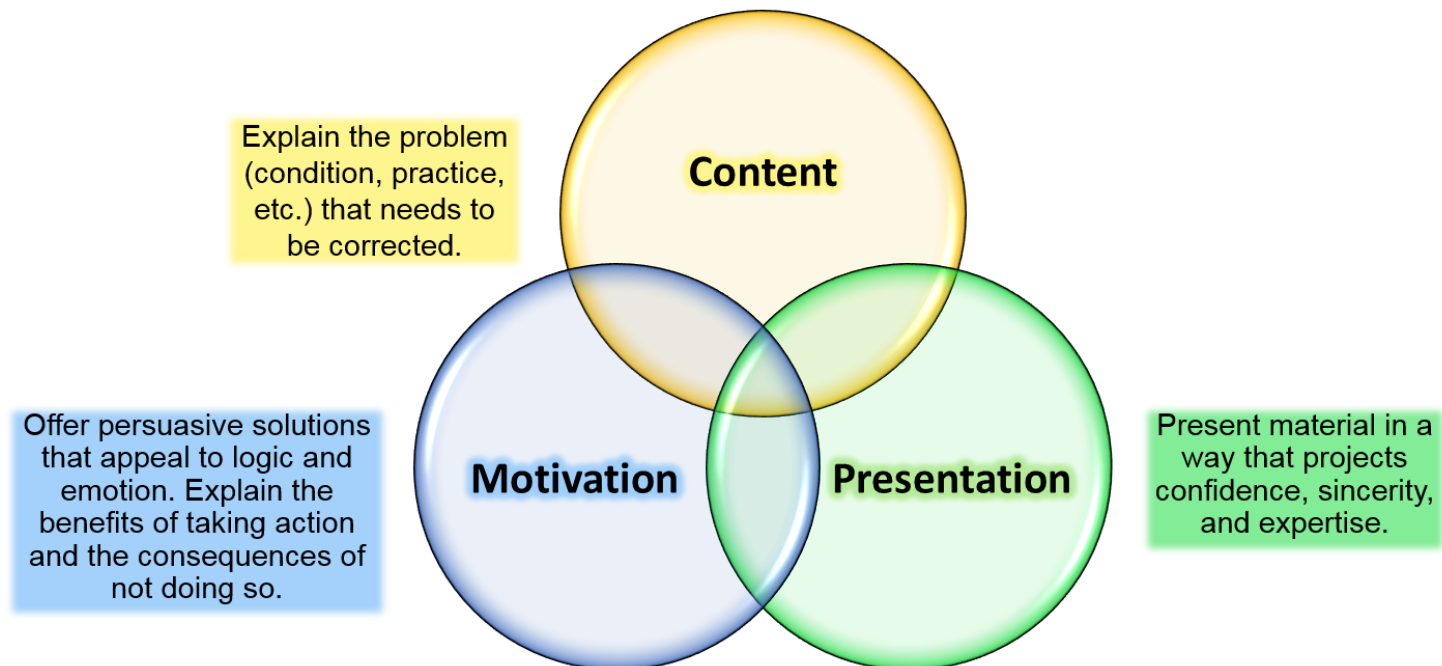
Option B



Option C

Persuade

Factors that Influence the Success of a Recommendation



Summary/Review

When making recommendations, we need to propose corrective actions _____ system improvements.

- A. instead of
- B. or
- C. rather than
- D. and

Engineering controls include all of the following, except?

- A. Substitution
- B. Enclosure
- C. Rescheduling
- D. Redesign

Which control strategy is most effective in eliminating hazards?

- A. Engineering controls
- B. Management controls
- C. PPE controls
- D. Personnel controls

All of the following are safety management system improvements, except?

- A. Writing a new safety policy
- B. Establishing a proactive incentive program
- C. Placing a guard on a table saw
- D. Revising an accident investigation form

Writing the Report

- Background
- Description of the accident
- Findings
- Recommendations
- Summary
- Review and follow-up actions
- Attachments



The primary responsibility of an accident investigator is to detail what happened during the accident and to uncover the indirect and root causes that contributed to the accident. It's not the investigator's job to place blame, but to remain as neutral and accurate as possible.

Summary/Review

Your primary objective, as an accident investigator, is to do what?

- A. Inform the employer about options.
- B. Place blame on those responsible.
- C. Hold the employer accountable for compliance with OSHA.
- D. **Uncover the causal factors that contributed to the accident.**

The accident report form should be designed to make it possible to determine what?

- A. Indirect causes
- B. Root causes
- C. Direct causes
- D. **All of the above**

The accident report should not be considered closed until when?

- A. It is signed by the investigators.
- B. It is presented to management.
- C. **All actions are complete.**
- D. The accident is recorded on the OSHA forms.

Putting It All Together

During this session, you have been introduced to:

- Basic accident investigation definitions and the characteristics of an effective accident investigation program.
- The six-step approach to accident investigations/analysis:
 - Step 1: Preserving and documenting the accident scene
 - Step 2: Collecting the facts through interviews
 - Step 3: Developing a sequence of events
 - Step 4: Determining the cause
 - Step 5: Developing effective recommendations
 - Step 6: Writing the report
- You should now have the tools needed to conduct an accident investigation at their workplace.

Receive Credit

<https://blt.lbl.gov/course/courselogin.aspx?cid=465>